DOCUMENT RESUME

ED 309 742 IR 013 849

AUTHOR Patterson, Janice, Ed.
TITLE Computers and Complex Thinking. May 1986 and October 1986.
INSTITUTION National Center on Effective Secondary Schools, Madison, WI.
PUB DATE 86
NOTE 25p.
PUB TYPE Collected Works - Serials (022) -- Reports - Descriptive (141) -- Reports - Research/Technical (143)
JOURNAL CIT Computers and Complex Thinking; May,Oct 1986

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Processes; *Computer Assisted Instruction; High Schools; Microcomputers; *Problem Solving; Videodisks

ABSTRACT

These two issues of a newsletter address the use of computers in developing complex thinking skills. The first issue, for May 1986, includes articles on: environmental science computer applications; computers and higher order thinking in Mineola, New York; a description of case study research identifying effective uses of computers in developing thinking skills; and a summary of computer education research in science, mathematics, writing and programming. The second issue, for October 1986, includes profiles of microcomputer usage in high schools in Eugene, Oregon, and Philadelphia, Pennsylvania, as well as articles on the use of computer and videodisc technologies to teach thinking skills, a computer network in Maryland schools, and computer databases designed for teacher training at Syracuse University. Both issues include brief reports of computer usage survey results, conference announcements, and software descriptions. (GL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED309742

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it
☐ Minor changes have been made to improve reproduction quality
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
F. M. Newman
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Computers and Complex Thinking

MAY 1986

National Center on Effective Secondary Schools
School of Education / University of Wisconsin–Madison / 1025 West Johnson Street, Madison, Wisconsin 53706
(608) 263–7575

Fred M. Newmann, Director
Janice Patterson, Editor
Hilary McLellan, Assistant Editor

Editorial

It happened at the White House during a ceremony conducted by President Reagan and U.S. Secretary of Education William Bennett. The occasion was the unveiling of What Works: Research about Teaching and Learning, a 65 page booklet for parents and teachers that contains "common sense" solutions garnered from 20 years of educational research. Following the briefing, reporters asked why the booklet doesn't deal with the role of computers in schools. According to one of the principal reviewers of the document, Herbert J. Walberg, professor of education at the University of Illinois Chicago-Circle there was no research consensus on the importance or effects of computer use in schools and, thus, it was omitted.

In the March 13, 1986 issue of Education Week that reported these events, it was noted that, in spite of many contrary opinions, there appears to be a firm consensus that teaching computer programming does not teach problem solving skills across disciplines. If this is true, then what is the rationale for schools spending so many resources teaching programming languages? Why do they use computers for any instructional tasks? How can problem solving and other complex thinking tasks best be taught to secondary school students? What strategies most effectively engage high schoolers in academic work? These are the types of concerns that have given birth to the focus for this newsletter.

In part, these questions arise from work underway at the newly funded National Center on Effective Secondary Schools that investigates ways to engage all students in instructional activities that stimulate complex thinking. It also builds on past efforts at the Wisconsin Center for Education Research, including the interna-

IR013849

BEST COPY AVAILABLE

tionally distributed publication, On Wisconsin Computing. Many responses to that newsletter asked for greater focus on secondary schools and, secondarily on using computers to teach complex skills. We hope that you will see this publication as one way of making contact with others who share your interests in complex thinking, secondary schools, and computer use.

Janice Patterson
Editor

Teacher Talk:

Environmental Science Computer Applications

Kenneth Dow
Computer coordinator
SAD 48
Newport, ME 04953

The Setting

Situated on I-95, midway between Bangor and Waterville, Nokomis Regional High School (student population of 800) is located in Newport, Maine (population 3500) and receives students from seven other smaller rural towns in Penobscot and Somerset counties. The overall catchment area is rural in the strictest definition with the area's economic base being an amalgam of farming, wood harvesting, service industries, and scattered sources of small industrial employment in textile, leather, shoe, and woodworking industries. Our curriculum is a traditional one, offering Earth Science to ninth grade, Biology to tenth grade, Chemistry or Physical Science to eleventh grade, and Advanced Biology or Physics the last year.

The Innovation

In the Environmental Science Project at Nokomis High School, students are using computers to analyze data they are collecting in original environmental research they are conducting on a river system undergoing large scale clean-up and restoration efforts. Utilizing the processes of science as learning tools, students can interact with their natural, social, and political environment and learn to make sound environmental choices. We are organizing a network of resources to use in high school courses and are determining the extent, on a continuous basis, that we can use resources from our natural setting as teaching tools.

The Implementation

With the richness and diversity of rural natural environments, students are cheated by being constrained in the classroom carrying out routine artificial exercises. Too many students report a dislike for science courses but take an active role when given a chance to participate in real and meaningful activities such as fieldwork. Fieldwork helps students develop an understanding and appreciation of the interdependency of ecological systems and an awareness of environmental problems and their impact on all levels of life. Students reach a level of sophistication that is difficult to equal with a textbook approach.

Arrangements were made to do runoff sampling for the Department of Natural Protection and stream survey work for the Department of Maine Resources. Other organizations involved included: Scott Paper Co., The Darling Marine Research Center, USDA's New England Plant and Soils Laboratory, The Nature Conservancy, and the U.S. Bureau of Sport Fisheries and Wildlife.

Students monitored spring runoff, generated river survey data, gathered fall foliage growth data, sampled fish blood for viral infections, and serviced a weather

station for the New England Plant and Soils Lab, and participated in an alewive stocking project.

To get a wider perspective of uses of our natural resources, tours were taken of: fish trapping and tagging sites; hydro-generating sites; harvesting operations on paper company woodlands; the Darling Center's aquaculture lab; and municipal, agricultural, and industrial pollution abatement facilities. Speakers from private industry, Dept. of Maine Resources, Dept. of Environmental Protection, the Darling Marine Research Center, Maine Warden's Service, Maine Fish and Game Dept., and U.S. Fish and Wildlife Service were utilized to demonstrate the complex social and political interactions which impact a river system.

Students computerized and analyzed field data to establish patterns and changes from previous data. They then wrote and submitted reports to the proper agencies summarizing the data and conclusions reached. Classes are now starting the second year's work on the ongoing projects.

The project is funded by an Innovative Educational Grant from the State of Maine Department of Educational and Cultural Services as a result of the Education Reform Act of 1984. The use of microcomputers has been an integral part of the project from the beginning but it is not a course in computer applications. Students have used computers in a variety of ways:

-the use of a full statistical package to conduct an analysis of the data generated by the water runoff sampling students conducted for the Department of Environmental Protection. The analysis has been used to establish base-line data the non-point- source contribution of phosphorus to the water shed. The sampling is on-going. The statistical work done by our students will be used to monitor changes in the water shed brought about by soil conservation efforts within the area.

-use of computer assisted graphing software to graph the data from the runoff sampling project and the weather station. The graphs are used in the analysis of the data.

-use of data base management software to develop a data base from a field study of fish within the water shed. Students conducted detailed data collection studies by catching fish and performing measurements and preserving lab samples of blood, scales, etc. We are told that this is the first time a data base of this kind has been developed. It will be used to develop background data on the condition of fish species in the area.

-as a spin-off of this data base management project some of our students have been involved with the Newport Historical Society in a project designed to catalog local historical documents. In this instance students took some of our computers to the Society and demonstrated how the software could be used to catalog the documents and then did the data base work for the Society.

-wordprocessing software has been used extensively by all students involved to produce reports and correspondence. Word processing is central to the storage and filing of all the work that has been done.

-spreadsheet software has been used to organize, present, and analyze data.

-students have used quiz generation software to write quizzes for the water safety component of the detailed river study that was conducted by our students.

-students have used a locally written piece of software to compile the science department budget for the school year and to print the purchase orders from that budget.

The computer equipment we have and the expertise that exists in our students have put us in a position to offer manpower and computer facilities to the state agencies we are involved with. Much

of the work would be impossible without the microcomputer equipment to handle the data.

Mineola Union Free School District: Computers and Thinking

Ari-Zev Anolic, PhD.
Director of Computer Education
Mineola Union Free School District
200 Emory Road
Mineola, NY 11501
(516) 741-1242

The emphasis in the Mineola, New York School district is on the use of computers as a tool. We have been consciously moving from teaching about the computer (literacy) and programming languages (Basic, Pascal) to utilizing the computer in all subject areas. It is very difficult to separate what we do on the secondary level from the goals and objective of our entire K-12 program. Our district maintains an approach to computer education that includes k-12 planning of programs that are integrated in a sequential fashion. For example, one of our most exciting uses of computers as a tool is in the area of teaching thinking skills via Logo and writing skills utilizing the word processor. These applications were begun on the elementary level and gradually phased upward into the secondary schools. With experience in using the computer as a tool in these areas, students and faculty were better able to begin using computers as a tool in various other subject areas as well.

On the secondary level, about four years ago we instituted a computer applications lab. This was in addition to an existing computer programming lab. We began the applications lab on the assumption that individual teachers were eventually going to have to learn to use computers in their subject areas as they currently use textbooks and overhead projectors. As such there were no formal expectations for this lab use with the exception of courses in literacy to introduce all our students to the broad issues and implications of computers. At the same time, an extended period of staff awareness and training was begun. Faculty meetings were addressed; inservice courses were offered throughout the year in areas of interest to the staff. Some of these courses were one-day workshops where teachers were given release time. Some of them were 15-hour after school workshops where teachers received course credits. Software review and qcquisition procedures were set up and centralized. Software demonstrations from various vendors were set up in the applications lab.

After the first year, teachers began to exhibit an increased interest in using the computers in various subject areas. As each teacher came to me, I attempted to meet their needs in implementing computer use in their area. For example, when the chairperson of Language Arts expressed an interest in using word processors, I arranged for her to visit our "Writing skills via computer program" on the elementary level to see the potential. We then selected the appropriate word processing software for her students and we arranged for an 8-session inservice for her entire department. The inservice was geared toward using the word processor in Language Arts and developing materials for classroom use. A significant number of our Language Arts students at the High School are now writing and composing using the word processor in the applications lab. This approach integrates and enhances our existing writing skills curriculum with the word processor.

Another example: our Drafting teacher was interested in using computer assisted drafting (CAD) in his class. After much research an appropriate software package and

the necessary peripherals were acquired. Based on this experience, this teacher and his supervisor initiated a grant proposal and we received a $10,000 grant for 4 very sophisticated CAD stations. After appropriate set up and training, our high school will have one of the most sophisticated computer assisted drafting setups in Nassau County.

In an attempt to keep this brief, I will highlight some of the other uses to which computers are being put in our secondary schools. In Math and Science the computers are used for demonstrations and simulations of concepts that are hard to present in a static way (graphing, science tool kits with temperature probes, pendulum sensors, etc.). In Foreign Languages, the word processor is used for various applications. In Business Education, in addition to Word Processing, the emphasis is on integrating databases and spreadsheets into the Business curriculum. We are currently training staff and writing curricula that integrates the use of databases in Social Studies and Science with word processors in Language Arts. In this way, in addition to expository writing on word processors, students will also be able to use the word processor to write reports in Social Studies and Science using information that they have previously set up on integrated data bases. Art students use sophisticated graphics tablets for drawing and design.

In addition we are involved in regional teacher resource and computer training centers and are currently implementing telecommunications and interactive videodisc technology into various subject areas (Earth Science, Art, Research Skills). The implementation of this diverse program has not always been a straight upward curve. However I have enjoyed strong support of the central administration, especially our Superintendent, Dr. Robert Ricken, and the School Board. As a result computer use has always been integrated into our existing curriculums, and issues regarding staff, location and equipment have been thought and planned out well in advance.

Our thinking skills program has been recognized by New York State in Thinking Skills Across the Curriculum: A Compendium of Thinking Skills Practices K-12, and the thinking skills and writing skills programs have been cited in the NADCO publication, Ideas and Programs of Merit - District Model Practices Exchange.

Research Notes:

Computers and Higher Order Thinking

The University of Wisconsin-Madison has received a grant from the Office of Educational Research and Improvement, U.S. Department of Education to establish the National Center on Effective Secondary Schools. We are one of ten centers which have been recently established at universities across the country to conduct wide ranging research for the purpose of improving education. The grants to establish these centers were awarded on a competitive basis for a five year term. This article profiles our computer research on identifying exemplary practices in high schools to determine conditions that support the use of computers for higher order thinking.

For several reasons, computers have special potential for stimulating and monitoring higher order thinking by high school students. Computers have the flexibility, often through simulations, to present challenging and complex problems (Linn, 1985; Patterson & Smith, 1986) to students working alone or with companions -- in ways which allow all students (not only the most verbally and mentally

facile) the opportunity to engage in problem solving (Bork, 1981). The facility of the computer of the very near future to assist students in posing problems, gaining access to new information, and testing possible solutions creates tremendous opportunities for increasing students' engagement in complex cognitive processes. Such activites may even help students learn to monitor their own thinking (see Papert, 1980). In addition, the ability of the computer to keep a record of student experiences and to tailor material to the level of the student makes possible a new range of testing situations which are not feasible in the conventional classroom environment (Fredericksen, 1984a, 1984b; Linn, 1985; Patterson & Smith, 1986; Pogrow, 1985). In short, a variety of observers have argued that the inherent power of the computer to provide individualized learning experiences can engage students in more complex academic activities than are routinely practiced in schools (see also Carr & Goldstein, 1977; Champagne, Klopfer, & Anderson, 1980; Lesgold & Reif, 1983). Each of these potential strengths of computer use could also be expected to enhance the general level of student engagement.

Unfortunately, these potential uses seem to occur only rarely in schools. Recent survey data indicate that the single largest category of computer use in secondary schools is devoted to "computer literacy" activities, followed by drill and practice activities in mathematics. Use in other content areas is minimal. Computer literacy classes focus on instruction in programming languages and emphasize acquisition of information about computers (Becker, 1984). Although some argue for the inclusion of programming as one way of teaching reasoning skills (e.g., Linn, 1985; Olson, 1985), these classes focus on low level programming tasks that don't challenge students' thinking skills. Further, the problem remains that most high schools are not using computers as an instrument for teaching higher order thinking in programming classes or across subject areas.

In addition, case studies of secondary school computer use indicate a number of factors that prevent even the most dedicated teachers from using computers. These include: (1) unreliable delivery of hardware and software, (2) inadequate teacher training, (3) lack of time to integrate software into the curriculum, (4) insufficient principal involvement and training, and (5) constraints of mandated curriculum (Cannings, McManus, & McCall, 1985).

These factors combine to impede the educational uses of computers in general, and for enhancing higher order thinking in particular. We are preparing a paper that analyzes these factors and suggests ways schools can overcome them. This analysis will be based on relevant research literature as well as knowledge gained from practitioners. We are particularly interested in the ways in which schools and individual teachers cope with various intellectual, cultural and institutional barriers to the use of computers for stimulating higher order thinking, and the ways that different uses of computers affect student engagement.

References

Becker, H.J. (1984). School uses of microcomputers: Reports from a national survey. Baltimore, MD: Center for Social Organization of Schools, The Johns Hopkins University.

Bork, A. (1981). Learning with computers. Bedford, MA: Digital Press.

Cannings, T.R, McManus, J.F., & McCall, C.H. (1985). Using the computer as a tool in the secondary curriculum - Seven case studies. Paper presented at the annual meeting of the American Educational

Research Association, Chicago, Illinois.
Carr, B., & Goldstein, I.P., (1977). Overlays: A theory of modeling for computer aided instruction. MIT AI Memo 406: LOGO Memo 40. Cambridge, MA: Artificial Intelligence Laboratory, Massachusetts Institute of Technology.
Champagne, A., Klopfer, L.E., & Anderson,J.H., (1980). Factors influencing the learning of classical mechanics. American Journal of Physics, 48, 1074-1079.
Fredricksen,N., (1984a). Implications of cognitive theory for instruction in problem solving. Review of Educational Research, 5, 363-407.
Fredricksen,N., (1984b). The real test bias. American Psychologist, 39, 193-202.
Lesgold, A., & Reif,F., (1983). Computers in education: Realizing the potential. Chairman's Report of a Research Conference. Washington,D.C.:U.S. Government Printing Office, June, 1983.
Linn,M.C., (1985). The cognitive consequences of programming instruction in classrooms. Educational Researcher, 14(5), 14-16, 25-29.
Olson, D.R., (1985). Computers as tools of the intellect. Educational Researcher, 14(5).
Papert,S., (1980). Mindstorms: Children, computers and powerful ideas. New York: Basic Books.
Patterson,J., & Smith,M., (1986)
Pogrow,S., (1985). Helping students to become thinkers. Electronic Learning, 4(7), 26.

A Summary of Computer Education Research in Science, Math, Writing, and Programming: Part II

Gerald Kulm and Sylvia Shafto
Learning & Instruction Division OERI

This paper presents part II of a summary of recent and current research in content areas which has implications for higher order thinking. Part I of Kulm and Shafto's summary, presented in the previous issue of the newsletter, covered research in mathematics and in cognition and learning. In this issue, the second part of the summary will be featured, covering research in computer programming, science, and writing. This summary is by no means comprehensive; it includes only research that the authors have been directly involved in monitoring or reviewing. This summary is organized around three types of work with computers.

Computer Programming

NIE has supported several kinds of research on teaching and learning computer programming. This research includes initial investigations of the feasibility of teaching programming to children of all ages, cognitive research on learning of general problem solving strategies while learning to program, and teaching research on effective uses of programming languages as a problem solving tool. Underlying most of this research is the question of whether computer programming can be taught in such a way that the student learns transferable problem solving skills.

Prototype software designed to enhance teaching programming to children has been developed through NIE research. Both enriched programming environments in LOGO (Papert,1982), and simplified pro-

gramming "microenvironments" such as Rocky's Boots (Learning Company, 1980) and Spiderworld (Dalby, 1983) have been developed.

NIE-supported research by Richard Mayer (1982) demonstrated that students understand the problem and the solution better if they state the solution using more than one means of expression, such as a computer programming language, a flow chart, and a natural language description.

The Bank Street College of Education (Kurland, et al.,1984) has addressed the issue of prerequisite and consequent knowledge in the context of students' learning to program solutions to problems using LOGO. Their research has included observations of students learning to use LOGO in a "discovery-learning" classroom environment, as well as a classroom environment using more structured teaching. An important conclusion of this research is that in both the typical discovery-learning setting and the more structured programming class, students do not learn to solve complex problems very well, nor do they appear to develop generalized problem solving skills as measured by tests designed to parallel the type of processes found in computer programs. Even at its best, the current pedagogy for computer programming is not teaching students how to solve complex programming problems and is not teaching any evident general problem solving skills.

The ACCEL Project (Linn,1985) has looked at cognitive prerequisites and consequences of students' learning to solve problems using Rocky's Boots, Spiderworld, and BASIC in classroom and non-classroom settings. Using standardized tests this project has evaluated students' cognitive skills before and after instruction in the uses of these specific problem solving tools. If planning strategies are taught explicitly, then students will show some evidence of improved general problem solving skills. The researchers further suggest that if students learn to use more than one programming language to solve a given problem they may more readily learn to generalize the process of problem solving. By solving the same problem in more than one language the student would differentiate the language of the solution from the solution itself. This argument is supported by Mayer's research mentioned above.

Current research at the Educational Technology Center (ETC) of the Harvard Department of Education (Perkins,1985) is focused on developing a model of the problem solving strategies used by students who are successful at learning to program solutions to typical classroom problems. Classroom experiments are being conducted which are designed to teach these strategies explicitly to students learning LOGO and BASIC. Although some of the identified successful strategies are specific to computer programming, many of them may prove to useful for students confronting complex problems in other problem domains.

Perlmutter and others (1985) are examining a different aspect of pedagogy which may affect students' success at learning to program. Children observed in classrooms enjoy using computers more when they work in pairs rather than singly. The researchers are investigating the importance of peer/peer interactions in cognitive development in the context of children learning to program in LOGO. It may be that working together helps children remain focused on a new problem domain when first beginning to work with computers, and working together on later, more difficult problems improves the students' chances of successful problem solving.

Much of the research in computer programming proposes that this is a unique medium in which students can solve complex problems

in an organized way, receive immediate feedback on their work, and eventually succeed at solving abstract problems while becoming cognizant of the process of solving the problem. While little experimental evidence supports this yet, it is still reasonable to expect that the research will yield valuable information on how students can be taught to solve complex problems.

Science

NIE-sponsored research and development in the uses of computers in teaching science has focused primarily on software development for simulations and related learning research.

Prototype materials were developed at the University of Pittsburgh Learning Research and Development Center (Champagne, et al, 1980) for simulating experiments in mechanics. These simulations were subsequently distributed to schools by a commercial publisher and given a Best Microcomputer Software of the Year Award in 1982 from the Learning Periodicals Group. The software was developed to do teaching and learning research on students' misconceptions (naive theories) in mechanics. The computer simulation allows the students to test their naive theories against Newtonian and Aristotelian mechanics while solving a few specific problems. Ongoing classroom research is investigating effective ways of using this computer simulation of natural phenomena to teach correct, but possibly counterintuitive theories.

NIE and NSF have supported development of laboratory tools (temperature, pH, light, and sound probes) which can be interfaced to microcomputers and augmented with real-time graphing software (see Wiser,1985). Through organizations such as the American Association of Physics Teachers, workshops throughout the country are showing teachers how to use these tools in science courses. The tools are integrated into one set of instructional materials for the Voyage of the Mimi.

The temperature probe and graphing software is part of an ETC research project on teaching and learning the concepts of heat and temperature (Wiser,1985). Classroom experiments have demonstrated improved understanding of these concepts when standard laboratory experiments are augmented with the computer software and probes. The accuracy and quickness of the computer's response and data representation apparently allows the students to distinguish clearly between the intensive (temperature) and extensive (heat) properties of a system in a way that conventional laboratory thermometers do not.

Related research at ETC uses a computer simulation of two dimensional density to teach young students about density of three dimensional objects (Smith, 1985). From experimental work, children learn about density properties of iron vs. aluminum bars more efficiently after they have worked with a computer simulation of two dimensional objects with different densities. A teaching unit is being developed using the simulation materials in classroom settings.

Another unit is being developed at ETC about the generation and empirical testing of scientific theories (Chomsky, 1985). Commercially available software is being used at certain points in the teaching unit. The software simulates a natural phenomenon, and the student performs a few experiments on the simulation, with results that are clear-cut and not confused by experimental error. A cognitive model for the student is being tested, and the software represents an important tool in addressing student needs at an early stage of the learning process.

While the science projects described above all seem to address

the teaching of isolated concepts, these concepts are all complex and important in the individual scientific disciplines. As such they most likely represent essential components of a problem classification system which is necessary for successful problem solving (Chi, and others, 1980).

Writing

Research in teaching and learning of writing includes prototype development of word processors for students (Bank Street Writer, Quill) and other software tools designed to simplify the task. The assumption for teaching and learning research is that if the computer eases the tasks of revision, spelling and grammatical construction, the student will be able to learn more quickly about the higher order tasks such as organization and argument (Butler, 1985).

Emerson and Stern Associates (1985) are developing an on-line spelling and grammar checker to augment a word processor. These will provide a student with immediate feedback on common errors at the word and sentence level. The researchers are currently developing these software tools in classrooms and are exploring ways they can be used effectively to teach spelling, grammar and writing.

At the Wisconsin Center for Educational Research (Dickson, 1985) a combination of software and voice synthesizer is being used to give students feedback on what they typed using a word processor. Experimental work to date suggests that students are greatly helped in finding spelling and grammatical errors using these tools.

In related work on computer augmented writing, Dickson has developed software which allows a teacher to select images off a videodisc which a student can then use to inspire and illustrate a writing composition using a word processor. Preliminary work shows that students are productively working with the system.

The above new software prototype work has not been used yet to address questions about student cognition and the teaching of writing. However, there is research addressing issues of how teachers are using computers and word processing software. For example, Gazden and others (1985) are evaluating the role of the teacher and the process of assimilation of the computer and the Quill into teaching writing. They are also analyzing writing samples from the students to determine if use of Quill is associated with any changes in writing style or productivity. Similar research is being conducted by Mehan (1985) with preliminary observations noting that teachers do not change teaching styles noticeably in the first year of using word processors to teach writing; when a teacher is given the responsibility of integrating the tool into a regular class setting it is not clear if there are readily observable changes in teaching and learning.

Research in uses of computers in teaching writing is only beginning to adress questions of cognition and teaching. The software tools are only now being developed, and the implementation research is still to be done.

Summary

In all three areas, mathematics, science, and writing, prototype software has been developed which is already being used in schools to teach complex problem solving. Uniformly, the design of the software and teaching materials places the student in charge of interacting with the computer in an open-ended context. In addition, the use of the software is designed to be integrated into the class by the teacher.

The ongoing research associated with evaluating the utility and effectiveness of the software is

shaped by the knowledge that the materials will be used in a normal classroom setting. Most of the research described above has included teachers at all stages of development or testing. The teacher will ultimately decide how these new tools are to be used.

Teachers are usually involved in the development and teaching research. Their interest and participation has often been the impetus for the research.

The Research Into Practice Digest

The Research Into Practice Digest provides educators with readable reviews of educational research. Each issue of The Digest contains a summary of over 100 research studies in a particular content area, along with concrete suggestions for how that research can be applied in the practical school setting. Each 30 to 60 page issue of The Digest is prepared after reviewing from 100 to 200 research articles on a single topic and then summarizing the data.

It is written in lively, non-technical language that makes it accessible to the professional and lay audience alike, including teacher educators, school board members and classroom teachers.

The issue on Computers in Education (Vol. 1, No. 3) covers:

* Research on Computer-assisted instruction.
* Is CAI the most cost-effective approach to providing drill and practice?
* Programming skills and the job market - is there really a demand?
* Does programming develop thinking skills? - A look at the research
* What can you do to improve programming instruction? - Research- based suggestions.

All issues of The Digest that we have seen contain in-depth summaries of topics that will interest computer educators who want to use computers as one way to stimulate complex thinking skills. For more information: The Center for Research Into Practice, Suite 310, 1718 Connecticut Avenue, N.W., Washington, D.C. 20009; (202) 537-1620. Subscriptions are $38.00 per year.

Top Software for 1985

The Sky Travel program, by Commodore Business Machines, has been selected by Science 86 magazine as one of the top instructional science software packages of 1985. Other winners include:

* Adventure Writer, by Codewriter Corp.
* Algebra Word Problems I: Motion, II: Area, perimeter and Lever, III: Mixture, Coin, and Investment, and IV: Percent, Mixture and Age, by Microcomputer Workshops Courseware.
* Bank Street Storybook, by Mindscape, Inc.
* Bataille des Mots, Batalla de Palabras and Wortgefecht, by Gessler Educational Software.
* Dinosaur Dig, by CBS.
* Educalc, by Grolier Electronic Publishing Inc.
* Exploring Tables and Graphs, by Weekly Reader Family Software.
* Fischertechnik Computing Kit, by Fischer America Inc.
* Kid Pro Quo, by Softsync Inc.
* Magic Slate, by Sunburst Communications Inc.
* Newsroom, by Springboard Software Inc.
* Quations, by Scholastic Inc.
* Remember!, by Designware.
* Road Rally U.S.A., by Bantam Books.
* Where in the World is Carmen Sandiego?, by Broderbund.
* Wilderness: A Survival Adventure, by Electronic Arts.
* Writing Adventure, by DLM Teaching Resources.

A more comprehensive guide to current educational software is the 1986 edition of Only the Best: The

Discriminating Software Guide for Preschool-Grade 12, an annual report by the editors of School-TechNews that covers some 7,800 program evaluations and over 200 software programs that received the most favorable reviews. Copies of the 1986 Only the Best guide cost $19.95 prepaid, or $21.95 for billed orders. To order a copy, contact Education News Service, P.O. Box 1789, Carmichael, CA. 95609; ph. 916/483-6159.

Toward Sex Equity in Computer Education

A project funded by the Women's Educational Act Program, U.S. Dept. of Education, is planning to develop an institutional self-study guide to assist elementary, secondary, and postsecondary educators who seek to identify and eliminate barriers to computer education for girls and women.

At this stage, input from educators is needed. To contribute information, write for a packet of materials from Dr. Judith E.Jacobs c/o HERS/Mid-America, University of Denver, Colorado Women's Colllege Campus, Denver, CO 80220.

Software-Textbook Skills Matrix

The Learning Company and Addison -Wesley have published a skills matrix that shows how their educational courseware packages are related to material presented in Addison-Wesley textbooks. The matrix is available free to educators. To receive a copy, send to: The Learning Company, Suite 170, 545 Middlefield Road, Menlo Park, CA 94025; ph. 415/328-5410.

Robot Invasion

Dean Seiwert
School of Education
University of Wisconsin-Madison

They're here. This isn't some science fiction story. The robots are invading our world! Every day there are more to be found. They have adopted an incredible variety of forms. Some are very unassuming, almost unnoticeable to the untrained eye. Others demand your attention, weighing tons and able to lift crushing weights.

Yes, the robots are here and they will stay. They can perform a wide variety of tasks, at work as well as at home. A robot, simply, is a device capable of effecting the physical environment in which it works in some defined manner. It's easy to spot the mechanical arm in action at thousands of factories across the country. But there are more subtle robots that become part of our homes. There are many computerized thermostats on the retail market, which when installed can control your furnace and air conditioning to maximize comfort while minimizing cost. Other systems will monitor your property while you are gone or asleep, watchful for intruder, fire, power outage or other emergencies.

One problem with these devices is that for most of us, they are quite foreign in nature. Not sure of how they work, they are black boxes full of wonder and mystery.

School House Robotics is a project through the University of Wisconsin-Extension designed to clarify the nature of robots for educators and students. This project focuses on computer interfacing and robotics using inexpensive, widely available material. The basic principles presented underlie the mechanical functioning of all robots and computer controlled devices.

The manual for this project, Schoolhouse Robotics* is divided into four units with a fifth in

development. Each unit covers one aspect involved in the connection of the computer to the outside world. The first unit introduces the output of information used to control a simple circuit. Next comes the control of motors, the input of information into the computer from the environment, and the combination of several functions into a single controller. The fifth module will discuss the conversion of information from digital (a measurement used by the computer based on discrete steps) to analog (a measure along a continuous range of values). All activities are hands-on and include descriptions of the circuits and components involved.

The Schoolhouse Robotics Project has been conducting classes since the summer of '85 that focus on introducing teachers to robotics. The classes have been organized through the Wisconsin Extension and are offered for credit. These courses have been offered both on the University of Wisconsin campus as well as remote sites around the state, with the number of sections dependent on the number of interested people.

For further information about Schoolhouse Robotics, contact:

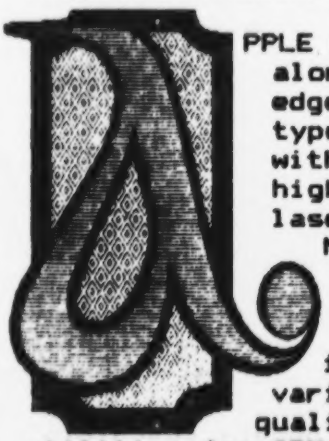
M. Vere DeVault
Room 476
Teacher Education Building
225 N. Mills St
Madison, WI 53706

* Published by UW Education Extension, University of Wisconsin, 160 Education Building, Madison, WI 53706.

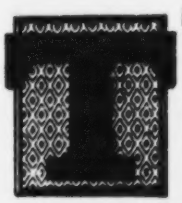
icrocomputer Typography

By A.L. Divine
Wisconsin Center
for Education Research

Microcomputers have found their way increasingly, into almost every aspect of our culture and our private lives. New applications are found and adopted almost daily. As hardware and software begin to mature, so relatively speaking, do the forms of communication we use (particularly in the schools), change and mature. With recent improvements in graphics capabilities of several brand name microcomputers there are powerful implications for educators over the long range in terms of educational materials.



PPLE was at one time alone, on the cutting edge of microcomputing typesetting technology with its Mac Intosh and high res dot matrix and laserjet printers and MACWrite software. Since then other software developers have inventoried a variety of typesetting quality word processor utilities for IBM and IBM-compatibles using an EPSON or other dot matrix or laserjet printer. Not only do these software packages allow the user to design documents and the type they will use in them, but they permit the mixing of musical notation, ancient hebrew and Gaelic Ogam scripts, and math notation, on the same line. And as SoftCraft of Madison, Wisconsin advertises in regard to their 'Fancy Font' system, near-typographic quality can be obtained from an ordinary dot matrix printer.



he days when commercial printers and the typographic industry (consisting principally of three or four major typographic firms), controlled the design of educational materials, may be at an end. Type, ever since its invention by Gutenberg, has been cast in metal (in 'stone' as it were), and

stored and maintained as though it were of gold. Some type designs are nearly 500 years old, and in spite of the knowledge educational researchers have amassed concerning readability and comprehension some of the least legible typefaces seem to keep appearing in texts. Even with the advent of phototypesetting systems, the educator end-user has had only limited access to the letterforms and page design which are selected to be used in producing their printed document or book. It would nice to believe the recent development in software-based microcomputer typography may eventually give rise to a significant growth in typographic expression in a way that has not occurred since the invention of type, i.e., the production of a modern sort of... microcomputer generated 'BOOK OF KELLS' for students in school.

raphics and headlines for this issue of Computers and Complex Thinking, as well as the text, have been formated and printed using several brandname microcomputers and dot matrix printers.

For a list of available microcomputer typographic software, see the May 12 1986 issue of COMPUTER GRAPHICS TODAY. It has a comprehensive listing of the software, addresses and phone numbers of the manufacturer, and the current pricing for each particular typeographic software package.

COMPUTERS AND COMPLEX THINKING NEWSLETTER
Janice Patterson, Editor
National Center on Effective Secondary Schools
School of Education
University of Wisconsin-Madison
1025 West Johnson Street
Madison, WI 53706

Nonprofit Organization
U. S POSTAGE
PAID
Madison, Wisconsin
Permit No. 1622

ADDRESS CORRECTION REQUESTED

Computers and Complex Thinking

OCTOBER 1986

National Center on Effective Secondary Schools

School of Education / University of Wisconsin–Madison / 1025 West Johnson Street, Madison, Wisconsin 53706
(608) 263–7575

Fred M. Newmann, Director

Janice Patterson, Editor
Hilary McLellan, Assistant Editor

Editorial

We regret that this will be the last issue of the Computers and Complex Thinking Newsletter. The newsletter began as a way to bridge a former newsletter, On Wisconsin Computing, established under the previous Center with the mandate of the new Center on Effective Secondary Schools. When funding for the prior Center terminated, the newsletter might have died, but it found some hope for continuing in an initial, but only provisionally approved, research project on the use of computers in high schools within the new Secondary Center. The Secondary Center has a broad mission that extends beyond the use of technology to improve high schools. The Center's work is reviewed each year, and this broader mission, plus a scarcity of resources led to a decision to discontinue the study of computers in high schools of which the newsletter was one part.

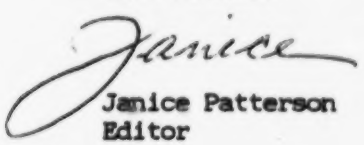
The Center will continue research on higher order thinking in the high school curriculum, focusing initially on issues of adolescent development, organizational constraints, and the study of history and social studies. It will also publish two general newsletters and two resource bulletins per year on secondary school issues, some of which may deal directly with technology. If you wish to be placed on the general mailing list, please let us know.

If your interests are particularly focused on computer use to teach complex thinking, watch for a NCESS report to be released in January, 1987. Barriers to using computers to teach thinking will be identified that include and go beyond the usual hardware and software acquisition and evaluation, teacher training and curriculum integration. This broadened conceptualization includes knowledge about school culture and other organizational features of schools that promote or inhibit

IR013 849

educational change as well as research on the effects of technology on teachers. Please contact me for more information or to let me know what you may be doing that relates to this project. You are encouraged to continue your involvement and interest in our work.

Best Wishes,



Janice Patterson
Editor

TEACHER TALK

High School Profile: South Eugene High School

Tom Layton
Computer Coordinator
South Eugene High School
400 East 19th Avenue
Eugene OR 97401-4190

South Eugene High School is located in Eugene, Oregon at the southern end of the Williamette Valley midway between the Cascade Mountains and the Pacific Ocean. Using computers as tools in the content areas is one of South Eugene High School's highest priorities. Three years ago South had only one Apple computer which was used for instruction within the building. Today it has over 90 in use by faculty and students. Next year will see an increase of about another 20. This is particularly significant when one considers that less than 15 of the machines were the result of grants and awards. The majority of the computers came from the budget that supports textbooks and supplies. Since these monies are controlled by the faculty council, one can sense the staff's commitment to computers in education. This commitment extends into teachers' homes because nearly 70% of the faculty own their own personal computer. Furthermore, South is the only high school in the area whose computer specialist is not required to teach regularly scheduled classes. My duties include staff training, consulting in curriculum, hardware/software development and maintenance.

In 1982 South initiated a microcomputer lab for programming instruction and open student use. In 1983 programming and computer literacy instruction were moved to other parts of the building and the Computing Center was established to provide free access to computers for students and as a teaching station for the English department. All 10th grade English students came to the Computing Center for two weeks of composition and used a word processor. In 1984 the Computing Center extended its hours for students and staff to the full academic day (7:30 - 4:00) and began to attract teachers from other content areas which included math, science, foreign language (German word processing) and social studies; as well as classes for Hearing Impaired Learning Disabled, English as a Second Language, and the Trainably Mentally Retarded. It became obvious to the content teachers that too much time in the Computing Center was spent teaching students how to use the hardware and software and not enough time was left for teaching the subject area. As a result, in 1986, all freshmen will be advised to take a new Computer/Keyboarding Core class designed to teach students to type and to use the hardware and software necessary to successfully participate in the content courses at South. Six sections of the course will be offered.

The growth of the Computing Center for computing in the content areas contrasts sharply with the history of programming in the building. Four sections of computer programming had been offered at South originally. As of next year, however, only one programming class will be offered in PASCAL for students who wish to prepare for

the advanced placement exam in programming.

As an aside, it is interesting to note that the problem of sex equity in computer use that was so frustrating with programming classes, seems to have disappeared completely when computers are used in content areas. The Computing Center originally was dominated by males. Today, the center leans slightly to more use by females.

The overriding use of computers at South is as a tool rather than as a drill master. Those early drill-and-practice programs we purchased mostly gather dust. Most computer use seems to center around one all-purpose program — AppleWorks. Of course the English Department found the word processing portion of the program long ago. More recently, the science department and social studies department have discovered the data base. Both departments have developed their own databases for their students (one on the periodic table and one on statistical information of the nations of the world). In fact one database created by some of South's social studies teachers will probably be published by Scholastic this coming year and another may be published by Sunburst. In the next few years we hope to attract more content teachers into the Computing Center and to begin to explore the use of spreadsheets and other "tool" software with students and staff.

There are numerous "pockets" of computer use throughout the building. Briefly, some are as follows:

* The journalism classes currently publish the school newspaper and will publish the yearbook next year using Macintoshes, a LaserWriter, and a Pagemaker.
* A group of Global Studies students developed a database on International Terrorism using a Macintosh and the visual database Filevision.
* The business department currently teaches accounting, business machines, advanced word processing, and typing using computers.
* The teacher for weight lifting has developed a spread sheet to help manage the exercise regimen for athletes.

Computer Usage at George Washington High School

Carol A. Wacker
Principal
Bustleton Ave./Verree Road
Philadelphia PA 19116

George Washington High School is regarded as a pace setter in computer utilization in the city and surrounding suburbs. About two years ago we began to emphasize using the computer as a tool for problem solving throughout the curriculum.

Art Major classes are given at least a week's instruction on computer graphics on the Macintosh (MacPaint). In music, students have worked on instrumentation and writing original music on the computer. Students in Industrial Arts are given a week's instruction on Mechanical Drawing on the Macintosh (MacDraw and MacDraft). Microcomputer repair is a year course in the basics of system maintenance and repair taught by the Industrial Arts department.

Many English classes are taught word processing, mainly in connection with learning the writing process. Prewriting is done directly on the machine. Writing, editing, revising, publishing are all completed directly on the computer. Some classes have been taught creative writing with an accent on layout and design. Journalism students write their articles directly on the Macintosh (using MacWrite and Ready-Set-Go). The school has adopted the policy of presenting all printed materials in the most professional style possible. This has led to the use of the computer as a tool for desk

top publishing. The school newspaper, yearbook, daily bulletin, and all school related announcements are created with the computer. All school newsletters and informational booklets are also done on the computer. Page layout and design have become underlaying curricular objects that are truly multi-disciplinary. Remediation skills are taught to students who had low scores on a standardized reading test. SAT test taking skills were taught both on the Macintosh and the Apple IIe.

In mathematics, students have been taught speadsheets, data bases, drill and practice routines on both the Macintosh and Apple IIe. And in science, students have learned to interface Apple IIe's and peripheral devices to measure approximately 20 different quantities or qualities. They have also been taught to make charts and graphs from the statistical information. We have a very active program of science research at the school that has generated many award winners in local and state competitions.

In Social Studies classes, students have worked with simulations for economic models. They have worked with a simulation game for world politics called Balance of Power. Graphs and "clip art" have been used to enhance individual reports.

In Business Education, all typing students receive instruction in word processing. Accounting students learn spreadsheets and special accounting programs or templates. We have recently added programs for checkbook simulation, inventory control, electronic filing, accounts receivable and accounts payable.

Students in grades 10 -12 have the option to select half year courses in applications software. The emphasis of these courses is on using a word processor, a data base, and a spread-sheet. Students in grades 9 - 12 have the option to select full year programming courses from the following list:

A. Basic 1
B. Basic 2
C. Pascal (rapid)
D. Pascal AP
E. Assembly Language
F. Computer Literacy (1/2 year survey course that contains Basic and an introduction to software applications)

Telecommunications is taught as a half year major to the High Technology Track students in the 10th grade. The course involves the use of public access systems and commercial services (BRS, Compuserve, and Dow Jones.). A special 9th grade software applications course is taught as a full year major to students in the High Technology Track Program.

George Washington High School has 3 labs of Apple IIE and Franklin computers (approx. 100 systems) and a Macintosh lab containing 33 computers. The school library contains 5 Apple IIe computers and there is a Science classroom containing 5 Apple IIe computers. Students are learning electronic searching skills through the BRS program in the library.

The Mentally Gifted office contains 6 Apple IIe and 6 MacIntosh computers. The Mentally Gifted Program has served as the forum for testing new software and new hardware. Through the use of this advanced field testing decisions can be made about implementation throughout the school. Topics such as page layout, 2 dimensional and 3 dimensional digitizing, scientific interfacing, and telecommunications have recently evolved from the testing stages into "regular" classroom instruction. The Eagle's Net BBS - an interactive bulletin board system - is operated as part of the Mentally Gifted Program.

The school counselor's office is connected by 2 terminals to the VICS service which provides data bases for career, college and scholarship information.

Research Notes:
Computers, Videodiscs and the Teaching of Thinking

John Bransford, Robert Sherwood, & Ted Hasselbring,
Learning Technology Center
Vanderbilt University
Nashville, Tennessee

(This is an excerpt from the Conference on Computers and Higher Order Thinking, October 1985, sponsored by the Wisconsin Center for Education Research. The full paper will appear in the proceedings of the conference, to be published soon.)

Several programs have been designed at the Learning Technology Center at Vanderbilt University to enhance students' abilities to think and solve problems by providing computer controlled-access to information stored on videodiscs. Simple computer programs allow people to access segments from random-access videodiscs. Using this technology, we can quickly backtrack and re-examine events in the video media — a luxury that heretofore was reserved only for texts. This technology also permits the generation of graphics and text overlays over the video. These programs are prototypes that are being developed for research purposes; they are not products ready for commercial distribution. These prototypes create contexts for problem solving by using segments from intact movies such as Raiders of the Lost Ark, Star Wars, and King Kong.

Movies provide extremely rich contexts that can be "mined" for opportunities to help students improve their abilities to think and solve problems. A major goal of our research is to explore the concept of idealized learning environments — "Havens" — that can facilitate learning.

We are attempting to identify ways that videodisc technology can help teachers recreate the kinds of advantages that tend to occur in natural learning environments. We are especially interested in promoting transfer of thinking and problem solving skills by providing students with rich opportunities to notice or identify potentially solvable problems in video segments and "everyday life segments", and to define these problems from a variety of perspectives. When concepts and procedures are discussed in the context of a specific video segment, that segment can be replayed and students can attempt to generate the information that was relevant to that video segment. Eventually, we plan to produce our own videodiscs, but first we need to learn how to use computers and videodiscs most effectively, using commercially produced films.

Our projects are designed to enhance thinking and learning by considering two levels of generality:

1. An emphasis on general processes of problem solving that occur in a wide variety of settings. For example, an emphasis on Identifying problems, on Defining and representing them with precision; on Exploring plans for solving problems; on Acting on the basis of plans and Looking at the effects (e.g. see Bransford and Stein's IDEAL Problem Solver, 1984; Bransford, Sherwood and Sturdevant, in press; Bransford, Stein, Delclos and Littlefield, in press. Other descriptions of general approaches to teaching thinking and problem solving can be found in Brown, Bransford, Ferrara and Campione, 1983; Segal, Chipman and Glaser, 1985; Sternberg, 1981).

2. An emphasis on the acquisition of specific concepts that take the form of conceptual tools that students can think with rather than mere facts that they can only think about (e.g. see Bransford, in press; Bransford and Nitsch, 1978).

When concepts and procedures are discussed in the context of a

specific video segment, that segment can be replayed and students can attempt to generate the information that was relevant to the video segment. Coupled with our emphasis on general as well as specific factors underlying effective problem solving is our attempt to provide opportunities for both (1) receptive and (2) productive or generative learning. Some of our videodisc software is designed to facilitate receptive, comprehension-based learning. Other software is designed to enable students to become producers of high-quality stories and lessons that involve a combination of text plus video. Video can provide a context for helping students generate their own problems and lessons, hence they learn by teaching.

As an initial step in conceptualizing Havens - ideal learning environments - we focused on young children's remarkable abilities to learn despite a number of disadvantages such as lack of knowledge, lack of sophisticated learning strategies and possible limitations on working memory. The efficiency of children's learning seems to stem, in part, from the advantages of learning in context. Furthermore, children are helped considerably by the presence of mediators who arrange environmental conditions and provide feedback and instruction that is uniquely suited to the performance level of the child. Mediators also help children recreate mutually familiar contexts so that discussion and instruction can more readily take place. In contrast to these advantages of everyday learning in childhood, children's formal educational settings are often forced to learn out of context, in part because their teachers may have little knowledge of the types of experiences that each child could use in order to better understand the intended instruction. By using technology to make instruction more similar to the experiences normally available to children, we hope to increase the speed and ease with which learning takes place in formal educational settings such as schools.

A rich context for learning combined with an effective mediator provides a major advantage to children. Since they learn in the context of everyday activities, they can understand the functions of information for solving everyday problems. In short, they are helped to acquire conceptual tools that they can use to think. In contrast, in the decontextualized environment of many academic settings, students often learn only facts to be memorized rather than rich, conceptual tools. We are trying to recreate the advantages of natural learning environments with computer and videodisc technology.

References

Bransford, J.D. (in press). Enhancing Thinking and Learning. New York: W.H. Freeman & Co.

Bransford, J.D., & Nitsch, K.E. (1978). Coming to understand things we could not previously understand. In J.F. Kavanaugh, & W. Strange (Eds.) Speech and Language in the Laboratory, School and Clinic. Cambridge, MA: MIT Press.

Bransford, J.D., Sherwood, R.D., & Sturdevant, T. (in press). Teaching thinking. In J. Baron & R. Sternberg (Eds.), Thinking and its Assessment. New York: W.H. Freeman & Co.

Bransford, J.D., & Stein, B.S. (1984). The IDEAL Problem Solver. New York: W.H. Freeman & Co.

Brown, A.L., Bransford, J.D., Ferrara, R., & Campione, J. (1983). Learning understanding and remembering. In J. Flavell & E. Markman (Eds.) Museen Handbook of Child Psychology, 1. 2nd Ed. Somerset, NJ: John Wiley & Sons.

BITS 'N BYTES

TWIST–A–PLOT CONTEST

Scholastic Software is sponsoring a contest through Apple Computer Clubs International. Kids can win up to $280 worth of software.

The contest invites youngsters in grades two through eight to create an original project based on the Twist-A-Plot adventure programs found in each edition of Scholastic Software's MICROZINE software series. These adventure programs are designed to reinforce critical thinking, problem-solving and computer literacy skills. Twist-A-Plots are interactive fiction-writing exercises designed so that users can choose a variety of plot options to create their own adventure stories.

To enter the contest, children can select from a variety of projects based on any Twist-A-Plot/MICROZINE program: they can illustrate the plot, or a scene from it, in a poster, picture, picture book, cartoon or computer graphic program. They can create a new ending to an adventure or even an original board game based on the adventure.

Twenty-four winners will be selected to receive MICROZINE software and Apple Computer Club merchandise. Children must be members of Apple Computer Clubs International to enter, and entries must be postmarked no later than November 15, 1986. Contact: Apple Computer Clubs International, MICROZINE Contest, 175 Middlesex Trnpk., Redford, MA 01730, (800) 343-1425 Or (617) 271-0040.

MICROCHIPS AND WATER QUALITY

Microchips and Water Quality

The Microchips and Water: Menu for Tomorrow project, funded by a grant from the Education Affairs division of Apple Computers, Inc., is in its first year of operation at Moses Lake High School, a small agricultural community (population 12,000) in the middle of Washington state. Under the direction of teacher Dennis Lundeen, students of agriculture and the sciences will use Apple computers in an ongoing study of how agricultural chemicals are affecting Moses Lake. Two soil beds have been established as test sites and aquariums have been set up to explore the impacts of agricultural chemicals introduced to the experimental soil beds. Tissue samples from fish in the aquariums will be examined in addition to water quality monitoring. Researchers from Washington State University will be assisting in this project. Moses Lake High School was in the process of updating its curriculum, with assistance from Washington State University, when teacher Lundeen conceived of developing a program in conjunction with the local Clean Lakes Project. An Apple Education Grant provided computers for analyzing the data collected. The Microchip project was one of the first programs to introduce computers to Moses Lake High School.

COMPUTER NETWORK IN MARYLAND

The Maryland Educational Television (METN) is conducting a pilot project in seven schools, with non-material assistance from IBM. This project, designed to provide a network between schools and also local area networks within individual schools is based on three goals for implementing computers in the schools:

1. equity
2. efficiency
3. economy

The funding has come from the districts where pilot sites are located. Districts were asked to volunteer for the pilot project

which required a pledge of $50,000 in financial commitment. Seven sites were selected from 28 applicants, based on need. Not all pledge money has been spent, but $10,000 was required to finance software support, substitute teachers for teachers who went in for teacher training, and room remodeling to house the computer labs. One school spent only $17,000; another spent $100,000. Each site is equipped with 30 computers, IBM Jrs and PCs, linked to a teacher control station in a local area network. Each school decides how to organize the computers: most have a single computer lab but one school has distributed the computers in different departments within the school.

The state Department of Education provides coordination and access to resources but not control; the districts decide how to use the computers as they see fit. Services provided by the state DOE include:

(1) The Express newswire.
This service costs $20.00 month to lease, plus communication costs, which the state helps to support. This newswire system includes UPI, TASS, and the Mexican news service (in Spanish) among other services.

(2) The Gateway-EZE database service from Addison-Wesley.
This service provides 78 databases; most are general interest with some specialized databases geared to a nonprofessional audience.

(3) Network coordination.
The state provides the network hub and system operation of communication between the different schools that are linked via computer and modem.

(4) Software distribution.
The METV network, in its second year, shows great diversity of implementation in the seven pilot sites. Teachers in a variety of subject areas (social studies, language arts, science, special education, etc.) have designed creative ways to integrate the computer resources into the curriculum. Initial results are promising.

REGIONAL CONSORTIUM FOR EDUCATION AND TECHNOLOGY

The Regional Consortium for Education and Technology (RCET) is providing leadership for using technology in education in the St. Louis area. RCET is a rapidly growing organization, working to build a strong educational network in the St. Louis County, Franklin County, Jefferson County, and St. Charles County in Missouri. RCET is a membership organization made up of public school districts, private schools, school affiliates, colleges and universities, non-profit organizations, and businesses. Its current members include 34 school districts, 9 universities/colleges, 11 not-for-profit educational organizations, and 4 businesses. RCET provides leadership by recognizing, supporting, and encouraging technological applications which have proven to be successful and by seeking out the pionnnering efforts which hold the promise of becoming the educational standards of the future. Therefore, RCET's primary goal is to serve the present and future needs of its members by providing information about the present uses of educational technology and by promoting the development and use of new technologies.

The Consortium provides these resources and services for its members:

Annual Technology Conference
Inservice Program
Resource Center
Classroom Facilities
Newsletter
Repair Service
Member Purchasing of Hardware
Member Purchasing of Software
Technical Phone Support

MECC Membership
Business/School Partnership Programs
Roundtables
Colloquia
Electronic Bulletin Board

For more information about RCET, call (314) 991-3447 or write to RCET
10601 Clayton Road
St. Louis, MO 63131

COMPUTER USE IN TEACHER TRAINING

Computer Use in Teacher Training

A 1984 survey, based on a random sample of 428 colleges and universities found that about 90 percent of schools of education offer prospective teachers some type of computer training. For more information contact: Douglas Wright
Office for Educational Research and Improvement
Center for Statistics
U.S. Department of Education
Washington D.C. 20208

COMPUTER DATABASES DESIGNED FOR TEACHER TRAINING

At Syracuse University in New York student teachers can practice their skills on databases programmed with pupils' academic records before facing a classroom of real children. The software containing the databases, developed by Professor Greta Morine Dershimer, permits elementary education students to try out decision making on simulated pupils, placing them in reading and math groups, designing lessons and selecting teaching materials. The software also gives simulated information on test scores, social behavior and parent-teacher conferences. This software was developed with funding from Syracuse University and the U.S. Department of Education.

PATHWAYS TO ART THROUGH NUMBERS

At McKinley High School in Baton Rouge, Louisiana, sixteen Apple IIe computers, on loan from the Education Division of Apple Computers, Inc. are being used in a special project to restructure and integrate mathematical content into conventional art and design curricula. Researchers from the School of Design at Louisiana State University are collaborating with teachers at this inner city high school to develop a course in computer graphic design, using LOGO, and to train the teachers in methods of integrating computer graphic design into the school curriculum. For further information, contact Jeanie Bowlin, Math Supervisor, Baton Rouge Parish School District, (504) 922-5442.

NEW MATH SOFTWARE FROM SCHOLASTIC

Over the next four years, Scholastic Software will publish thirty new software packages designed to make mathematics concepts concrete and understandable for students by using a discovery learning methodology to clarify concepts. These packages will be produced under the direction of Ludwig Braun of the New York Institute of Technology with funding from the National Science Foundation and from Scholastic Software. "The Math Lab Project" will create software packages in algebra, geometry, trigonometry, statistics and calculus for secondary school math classes.

The first package, due out in January, will be **The Math Lab: Algebra**. For more information contact:

Scholastic Software
Scholastic, Inc.
730 Broadway
New York NY 10003
(212) 505-3000

RECENT RELEASES

Time for Results: The Governors' 1991 Report on Education. Report of the Task Force on Technology. Available for $6.00 from:
National Governors Association
Suite 250
444 North Capitol St., N.W.
Washington, D.C. 20001
(202) 624-5300

Computer Lab Tools for Science: An Analysis of Commercially Available Science Interfacing Software for Microcomputers. $12.65. Northwest Regional Education Laboratory
Document Reproduction Service
300 S.W. Sixth Avenue
Portland OR 97204

Solomon, Cynthia (1986). Computer environments for children: A reflection on theories of learning and education. MIT Press. $22.50.

Winkler, John D., Stasz, Cathleen, & Richard Shavelson (July 1986). Administrative policies for increasing the use of microcomputers in instruction.
Rand Corporation
1700 Main Street
P.O. Box 2138
Santa Monica CA 90406-2138

National Directory of Bulletin Boards
Meckler Publishing
11 Ferry Lane West
Westport CT 06880
(203) 226-6967

This directory, available for $9.95, references about 1,000 bulletin boards with topics ranging from avocational and personal areas to professional applications and reference sources.

COMPUTERS AND COMPLEX THINKING NEWSLETTER
Janice Patterson, Editor
National Center on Effective Secondary Schools
School of Education
University of Wisconsin-Madison
1025 West Johnson Street
Madison, WI 53706

Nonprofit Organization
U. S. POSTAGE
PAID
Madison, Wisconsin
Permit No. 1622

ADDRESS CORRECTION REQUESTED